DOCUMENT RESUME

ED 241 243 RC 014 668

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TITLE Ruralmicro: Computers and "Excellence" in Small Town New Hampshire.
INSTITUTION Education Development Center, Inc., Newton, Mass.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE Jan 84
NOTE 37p.; For related documents, see RC 014 667-669.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Boards of Education; *Change Agents; Computer Programs; *Curriculum Development; *Educational Change; Educational Improvement; *Educational Philosophy; Elementary Secondary Education; *Microcomputers; Program Implementation; Rural Areas; Rural Education; Special Education
IDENTIFIERS BASIC Programing Language; *Hillsboro Deering Cooperative School District NH; LOGO Programing Language; PASCAL Programing Language

ABSTRACT

The successful computer program in rural Hillsboro-Deering (New Hampshire) Cooperative School District was the result of a program of excellence in education adopted by a completely new and inexperienced school board in 1978. Supported both by oldtimers and by newcomers, the board acquired new administrators, purged the faculty, and acquired $15,000 for three Apple computers which were the basis of the computer program. The district hired a zealous computer instructor who, over the next six years, organized a computer room at the joint site of the elementary, middle, and high schools, and expanded it to include 20 Apple microcomputers and a wide variety of software. Always full of students, the casually-run computer room became the site of much learning for elementary, secondary, and special education students of all abilities. The computer instructor developed and taught an introductory computer course for the faculty and established an elaborate K-12 computer curriculum. Beginning in kindergarten with games and minimal word processing, the curriculum advanced students to subject area software, LOGO, and word processing during the elementary school years, started them programming LOGO in grade 8, and continued teaching them BASIC and PASCAL programming and independent studies in high school. (SB)

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Ruralmicro: Computers and "Excellence" in Small Town New Hampshire

by

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APR 1984
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January 1984

Center for Learning Technology
a division of
Education Development Center
Newton, Massachusetts

The case study reported herein was supported in part by the National Institute of Education (Contract No. NIE-P-82-0079). It does not, however, necessarily reflect the views of that agency.

RC 014668

Just past the town line is a trailer park, a strawberry patch where U-pick yourself, and Rocky's hot dog stand, its windows graced with with calico curtains. Deeper in, as New Hampshire Route 9 becomes Main Street, traditional New England appears: the Congregational Church, clock-faced and shining white; its Methodist counterpart nearby, clapboards peeling a little; an old mill on a river behind a stand of stores; even a covered bridge. But modern New England shows here too among the stores: Joe's Bargain Center, Najib's Pizza, Country Life Natural Foods. You can get a cup of coffee in a small diner where a waitress serving homemade pie to a truckdriver tells him that she wants to get away to the cabin her friend owns in northern Ontario. Or you can get a cup of "gourmet coffee, freshly brewed" in a bookstore across the street where friends lounge at a window table, talking astrology and planning a trip to London. Here the shelves of books are labeled "food," "health", and "inner development." The food shelf's collection runs from

Yankee Magazine's New England Cooking to the Book of Miso. Half a mile from the bookstore and the diner is the GTE Sylvania plant, windowless and concrete in a landscaped parking lot.

Hillsboro is in the Contoocook valley, on the northern edge of what is called New Hampshire's southern tier. In the past decade, the southern tier has been transformed by economic growth. Although the growth has been less pronounced in Hillsboro than in New Hampshire towns farther south, Hillsboro clearly does not conform to the stereotypical image of a rural community. To be sure, it is small; it is surrounded by farms, fields, and wooded hills; it is twenty miles from the nearest city of any size; the pace of life is a step or two slower than Boston's pace, or Manchester's; and people do not nod and wave to each other on the street.

Deering, Hillsboro's partner in the school district, is still smaller and more "rural" in all these respects. Deering is nearly all farm land, open fields, and wooded hills. Some of its citizens are poor or nearly poor in scrappy New Hampshire style, and their homes sit along narrow paved or gravelled roads, are plain and weatherbeaten, with propane tanks and wood piles beside them. On the whole, however, Deering is more prosperous than Hillsboro. Many Deering citizens own fairly large pieces of land, engage in white collar professions or are retired from them, and many also come originally from other places.

Both communities are still governed through the classic New England town meeting. But the large Sylvania plant just outside of Hillsboro, a nearby Digital Equipment Company warehouse, and the proximity of southern New Hampshire's h igh technology belt — the outermost of Boston's high tech Saturn-rings — these

outposts of urban mass society are here as well.

This is not the interior of Maine, which is poor, very sparsely populated, and dominated by logging and lumber. It is not the "Northeast Kingdom" of Vermont, cut off by weather and rugged geography from the rest of the state, where the bumpers of New York Volvos proclaim "I Lovermont" while the bumpers of pickups rejoin "Vermont for Vermonters." Nor is this northern New Hampshire, which gets its country music in French from across the border.

Yet, while Hillsboro-Deering does not remain pure Norman Rockwell rural, it is a hybrid form which is growing more and more common in New England. For at least fifteen years, people from the cities and suburbs have gone "back" to small towns and rural areas. "Back" bears quotation marks because many of the urban refugees had never split wood or sugared maples or worn high rubber boots during mud season. The hippies may have been the advance guard, but the fed-up Wall Street lawyers were only a few years behind. In many New England towns, the influx of refugees from the city swelled as high tech research and development firms rippled out in rings from Boston. That fellow in boots, wool shirt, and a Solzhenitsyn beard packing groceries into the back of his long-bed pickup truck is about as likely to be an engineer for Universal Information Systems as he is to be a dairy farmer. As they "returned" to small town America, these affluent, educated newcomers may not have brought pot seeds and communes, but they have brought attitudes, styles, and expectations that clash and mix with those of the oldtimers, the natives. The role of microcomputers in Hillsboro-Deering Cooperative School District is best understood in the context of an unusual alliance of oldtimers and newcomers who set out to reform their schools.

Exponent of Excellence

One of the newcomers is Bob McWalters. McWalters lives in Peering, but practices law in an old farmhouse in Hillsboro, just down Main Street from the Sylvania plant. He is a country lawyer now, whose office window looks out on an unplowed hay field, but once he was a Wall Street lawyer. In 1976, he abandoned Manhattan and his daily five-hour ride on the Long Island Railroad for a rural practice and small town life. He was attracted to the simpler pace of New Hampshire and its more fundamental moral and political values. He feels and looks at home here now, almost as "native" as his friend and former school board colleague, Lawrence Duggan, who drops by on real estate business as we sit one day in McWalters' office. Both are plain-spoken, assertive, and conservative men, but where Duggan is reserved, McWalters is brassy and garrulous. Something of New York still sticks to him.

As we talk, he works at a large oval conference table cluttered with papers from an estate case he has just begun. From time to time he jumps up from this table that serves as his only desk to make a call on his wall phone. As he does, he tells us that he regrets he must now use seven digits in his local dialing instead of the four he used when he first moved to town. He reminisces about his school board days:

After living in the area only two years, McWalters says he "found himself running for the board one day." He attributes his landslide victory to the other candidate's unpopularity, and to a swelling popular demand for a "housecleaning."

The Hillsboro-Deering school system was "a joke" in those days, he adds — "the epitome of mediocrity." The growing perception of this condition by members of the Hillsboro and Deering communities led all five members of the previous board to leave it. Every member of the board to which McWalters was elected was new, "totally inexperienced, and extremely young." Ruth Colby was in her thirties, Stephen Hahn and Lisa Levin in their early twenties, and Jimmy Lamothe had graduated from high school the previous year. McWalters, the oldest member at 37, was chosen to serve as chairman.

One senses now that the board's choice of chairman was not based on age alone. McWalters' energy must have been then even more compelling than it is today, and his passion for innovation and willingness to play the point man must have been very appealing to a board wishing to "clean house."

McWalters describes the schools as he says the board viewed them in 1978: "an absolute shambles" physically, with an administration that lacked control over its staff and the respect of the community, unruly students, and a faculty of whom "a substantial number were just putting in time, collecting a paycheck." On the other hand, the superintendent was new and eager to rebuild the system, and the community seemed ready to rally behind whatever action the board saw fit to take.

So the board went to work. "We rejected the idea of 'satisfactory' or 'mediocre'," McWalters remembers. "We decided to accept only 'excellent'." The board put pressure on two of the three administrators in the system and secured their resignations. It sought replacements who were not only able and personable, but "who in their pasts had achieved something of an excellent nature." It chose

Bob Norton "to lead the charge" as the new principal of the high school partly because he had been a nationally ranked collegiate athlete and a sportscaster who had won an Emmy. At the same time, the board went to the town meeting, or rather its joint version — the annual district meeting — which deals with school appropriations for both Hillsboro and Deering to ask for a 25 percent budget increase, including a special $15,000 fund for "Academic Excellence." The request was approved.

McWalters recalls that the board really had no idea at the time how it would choose to spend this extra $15,000, and admitted this to the town meeting. The fact that the town meeting went along anyway is evidence of the potency of the political mood the board had stimulated, since this is, after all, New Hampshire, where state aid accounts for less than 10 percent of educational revenue, and so where most of the dollars spent on schools are locally raised. However, a short time later, the board decided that one of the things it wished to do with its new funds was to buy a few microcomputers. In a sense, these microcomputers became symbols of everything else the board did.

The most controversial part of this everything else was the board's decision to engage in what might be characterized as a faculty purge. It was the start of what McWalters now calls a "brutal story." The newly hired administrators devised a teacher evaluation system and began to apply it assiduously. After a number of poor evaluations, some teachers left voluntarily. Others were fired. Some among the latter, despite what McWalters admits was heavy personal pressure to leave quietly, decided nonetheless to fight termination with all the means they could summon. "Maybe we didn't appreciate how difficult it should have been for us," says

McWalters. "If we had had more political sense, maybe we wouldn't have attempted it." But having begun, the board did not back down. It pursued vigorously — some would say heavy-handedly — its vision of an excellent faculty, using evaluation, termination, pressure, and persuasion. It added litigation to this list too when one teacher took the board to court. When the case was decided in the board's favor two years later, all the resignations the board still sought came through.

McWalters shares credit for this "housecleaning" victory with his board colleagues and with the superintendent of schools, Thomas Watman. The latter accepts his share of credit, describing the process with a smile as "McWalters and Watman: guns blazing at the OK Corral." But he acknowledges, in effect, that his role was more that of the cowboy who provides "cover" for the one stepping into the clearing. McWalters "took the flak," he says, and it was stress induced by this flak, he feels, that caused McWalters to retire from the board.

For his part, McWalters admits the injuries. Some teachers made it difficult for his children, he claims. He lost some business for his law practice too, and he knows, he says, that some people in town will always think of him as "that vicious bastard from New York." Yet he has no regrets. "My comfort is that what we did was in the best interests of kids in this community."

Computers and Excellence

To introduce the role of computers in the campaign for excellence, McWalters tells the story of a tour he took in the late seventies, a tour of a guided missile frigate. Most vivid now in his memory of that tour is the view he got of the ship's

command room -- "black, but bathed in a kind of red or maybe blue light that made all the dials and indicators brightly visible." It was a room full of computers, he says, "like sci-fi." As he talks about it now, his eyes and words grow even more animated than usual. The room is a setting for a conviction: "I am convinced that the computer is the most significant tool to be used by man in the twentieth century."

Yet paradoxically, McWalters' sense of the computer's significance evokes not only his great interest in computer education, but also his caution. On the one hand, he would like the current board to insure that all Hillsboro-Deering children have access to a microcomputer from the time they can first manipulate its keyboard until their graduation from high school, while on the other hand, he does not think that anyone yet knows enough about this tool to say definitively how these children should be trained in its use. "Trying to discern the best way to handle computer education," he explains, "is so difficult because what we do now is maybe what we won't want to do next year." The solution to the dilemma, he feels, is to build vigorously, but with the "flexibility and guts to change course if necessary."

His perception of the nascent, protean quality of computer pedagogy is what made the computer a good tool as well as a good symbol in McWalters' "campaign for excellence." This is because the campaign was more than a purge and a recruitment drive. For McWalters, it was also emphatically an effort to penetrate the curriculum, unsettle it, and revamp it. The microcomputer seemed especially suited for such work. McWalters and Chuck Gaetes, the high school science department chairman, who together constituted the Hillsboro-Deering computer education planning committee, resolved early in their planning that the new program would not fall

under the sway of existing disciplines in the school, but would have interdisciplinary power, K-12. As McWalters saw it, Hillsboro-Deering computers should be used to teach "anything, anything at all," and they should be used "by students and no one else — no administrative purposes — and all students, not just a select group." He was particularly eager to avoid entanglement with the schools' existing bureaucracy, believing that "bureaucratic inefficiency saps the quality of a tool."

Initially McWalters and Gaetes considered buying a minicomputer like one owned by a neighboring town, and even secured the offer of a hardware donation from a manufacturer. But when they got wind, according to McWalters, of the costly annual maintenance contract that the equipment would require, they redirected their planning. They came to realize, he says, that they "needed something the kids could bang around, so we went with Apples. They were cheap and versatile, and they offered a substantial amount of software." They were also, he adds, an appropriately simple symbol of excellence, showing that "it's not necessary to have a lot of money to have an excellent school."

The first three Apples were set up in a "closet" at the back of Chuck Gaetes' science lab, and "the kids went crazy," according to McWalters' typically enthusiastic account. "We almost had to have police protection for those machines. As soon as school opened every morning, the kids were in there, and the custodian had to kick them out at the end of the day."

The fledgling program was judged so successful that the board felt it necessary to return to the annual district meeting the next spring for money to buy more

micros and to fund the part-time position of computer coordinator. McWalters had no doubts about who he wanted that someone to be.

Ken Pierce was McWalters' Deering neighbor who was working at that time as a math teacher and computer coordinator in another New Hampshire town. He had been a consultant to McWalters and Gaetes when they were making their first hardware purchasing decision, and had urged them to buy Apples. "In going after Ken," McWalters reminisces with a laugh, "we weren't concerned about anything or anybody. We were out to steal him, and even took him out for drinks one night to help persuade him." McWalters prized Pierce's personality as well as his competence. He knew that the computer operation he envisioned — free of bureaucratic and departmental entanglements, flexible, gutsy — needed Pierce's "total independence, total lack of formality . . . his abrasiveness."

Today, five years later, it is generally Ken Pierce who is given the greatest share of credit for the establishment of Hillsboro-Deering's microcomputer operation. Even one of its handful of critics agrees. She, an older native resident of Hillsboro, wishes Pierce were not so "hog wild" about expanding his hardware, and so she argues at school board meetings that he ought to be able to run a good program with fewer funds. Nevertheless, she is proud of the program he does run, attributing its success to "the fire in him."

Pierce calls himself "a zealot", and others agree. Bob Norton, who was principal of the Hillsboro-Deering High School until June of 1983, describes him as "aggressive, political, constantly edging to move into a void." He IS the computer program in many people's eyes, says Norton, so the program's success has become his

success, and "any animosity the program may have attracted" has become his too. Stephen Hahn, current school board member, associates Pierce with McWalters as men whose passion "creates emotions in all directions." In this respect they are, he might have added, like other actors in the recent and current story of the Hillsboro-Deering schools — people like Norton, school board member Bob Charron, and elementary principal Peggy McAllister. According to Hahn, it is one of the most characteristically rural things about Hillsboro-Deering that its size and culture give such strong individuals an opportunity to have a huge impact.

The Computer Room: Spring 1983

The Hillsboro-Deering schools are clustered in a complex of buildings and building additions several blocks from Main Street in the residential heart of Hillsboro. The center of the complex is the small high school building, circa 1927, tiny by city standards, two stories of highly polished, creaky oak floors. The 1957 wing that houses much of the middle school dates itself with a long one-story run of cinder block hallways and rooms that open to the outside. Other parts of the complex, including the elementary school, were built in 1952, 1969, 1974, and 1979, a trail of architectural changes and bond issues reflecting the schools' population growth. That population today stands at about 900.

The computer room is in the '57 section of the school complex, but near the point where the three schools intersect. One may enter it either through its own door from the outside, or through the high school corridor that runs to the gym past shops and the boys' locker room. It is a long rectangular room, once a simple classroom.

At the end of a hot school day in late spring, we find the room surprisingly cool, but Ken Pierce tells us that it turns hot quickly when it has "a couple of bodies per machine," which it does throughout most of a typical school day.

All the room's hardware is on long folding tables, the kind used in multi-purpose rooms for lunches, book fairs, and bingos. Three printers, including one that uses large primary type, share table space with twelve Apples. Two of the normal complement of fourteen tables are on loan to elementary classrooms for the day.

The folding tables, and indeed the absence in the room of permanent installations of any kind, give the space a temporary air like that of an election candidate's campaign headquarters. As we learn more about Pierce's program, this air seems to us not incidental to the program's style and purpose. "When they had to use all these tables here for the science fair," Pierce tells us, "I just shipped all the Apples off for a week to the elementary classrooms." The fact that the room has no software closet, he continues, merely creates an opportunity for research. "You just put all the software out on a table and sit around and watch for a year what the kids go for — the best research in the world. . . . Of course," he adds, "You can't be the kind of person who shrieks at the top of your lungs if someone drops a floppy disk on the floor."

Pierce does not so much introduce his room and program to us as illustrate them with stories and quick strides about the room to put his hands on this or that machine or disk. He has an intense presence, like his friend McWalters — an

energetic, expansive style. He is full of sharp statements followed by quick smiles that disarm and engage. He is loose in the way he dresses, big in the way he moves, and, like his room, casual.

He shows us a chart on one of the room's walls made of large pieces of poster board taped together — a schedule of the room's activities, indicating heavy use. At 12:42 each day, he explains, just as a high school programming class ends, "I get 25 first graders standing in line at the door, waiting for their turn at the room." On another wall hangs a large thank-you note from a first-grade class, with a big block-print "Dear M. Pierce. . . ," and a drawing of a keyboard with glued-on corn kernels for keys.

In a corner of the room, high piles of paper sit on a table next to a portable sink filled by a large, seemingly abandoned coffee pot. Another corner table is covered with floppy disks, many in shoe boxes. "We have more software than anybody in the state," Pierce volunteers dramatically, then rummages in a metal cabinet behind the floppy disk piles, pulling out simulations, "Minnesota stuff," a Koala Pad. "The fourth graders love this one (Conglomerates Collide)," he says, throwing it on the table, "and I understand the Harvard Business School uses it too."

This software collection is a product of Pierce's aggressive bargain-hunting. "I call up the software companies," he explains, "and I tell them, 'We're nestled up here in the hills. The nearest dealer's all the way in Concord. And I intend to buy two or three hundred bucks of materials this year' — which I do — that's the truth!" he adds in an aside, "'so what do I have to do to be a dealer?'" Once he becomes a dealer for a particular software company, he can get "for 14 bucks what

normally sells for $39.95. Can't make a profit as a dealer, though," he adds. "School won't let me."

Besides software, Pierce has accumulated a varied if miniature library of books and manuals. "Good books," he calls them, "but nobody uses them." People prefer to wade in, he explains, and discover for themselves how something works. "Nobody wants to spend a lot of time reading about it first. . . . Now, as an instructor," he admits, "I might have a tendency to say, 'Whoa! Do your homework before you sit down at that machine,' but that's just not the way it is." Pierce refers often to what he feels is his work's fluidity, its resistance to formal prescription and routine. "This job takes the right temperament," he says. "You have to be able to deal with the walk-ins and the different level kids, kids teaching themselves, doing things you never taught them."

Some of his room's informality is thus a response, he argues, to the demands of the technology. A good computer room cannot look like or function quite like any other school classroom, he says. As he tells his programming classes, "In most other classes, the teacher talks at the back wall and you intercept some of it, but this is different. It's you and the machine here. You use me as a resource and that's it." The distinction is fundamental to Pierce's conception of computer pedagogy.

As Pierce schedules it, the computer room is seldom occupied only by a single class with a single purpose. He likes a busy room with varied projects underway. Independent students, drop-ins, whole classes, and what Pierce calls "just-sit-theres" may all share the room at one time. "The room's open. Kids come

in. Oftentimes you're supposed to say, 'Where's your pass?' but I just like to let the kids drift in, even during a class. Sometimes a kid comes in who's had the class before, and maybe he helps his girlfriend who is taking the class now. . . . If it gets really crowded, I kick the just-sit-theres out." At his old school which was very strict about hall traffic, Pierce reports that he was the "catcher in the rye, leaning out from my door, grabbing the illegals from the hall, pulling them into the computer room."

Yet in the middle of his spirited defense of informality, Pierce acknowledges a need to surrender some. The computer room will be renovated over the summer, he tells us. It will have a carpet, a dropped ceiling, and some partitions — one to create a semi-private work space for three Apples, and the other to create a formal software dispensary. "We have to have the changes," Pierce explains; the program's success has created the need for better disk accounting, better housekeeping routines. "You can tell by looking around here," he adds, "that I'm not the world's most organized person." But, as if to illustrate some ambivalence in his welcome of the renovations, he follows his justification of them with a point he later reiterates: "You know, we functioned without any rules here this year. It's not that I'm against rules. It's just that we didn't know when we started what rules we'd need."

The Computer Room: Fall 1983

We arrive on a bright October day to find the Hillsboro-Deering computer room transformed. There are now twenty Apples. Three are in one of the two small rooms-within-the-room, and several older students work busily at them. They are

visible to us through glass windows framed with thick knotty pine molding. The pine softens the efficient look of the glass, the paneling, and the soft brown carpeting. It has preserved something of the plain and rural look of the old room. At the same time, the new partitions have altered the severe elongation of the old room. Now the room has corners where students can work or play without distracting those in the squared-off instructional center of the room. There, Ken Pierce can sit at a large table, as he does now, and view the work of ten or twelve students at machines all around him. He is close enough to read their screens and to offer them advice or encouragement, but not so close as to make them feel crowded or watched. The renovation is a success.

The students with whom Pierce is working are members of a general math class, offered to the school's lowest track. Most of them are playing against a nemesis called the Tax Man. He takes all the factors of numbers they choose from a list; they try to keep his take as small as possible by choosing carefully. They are relaxed. They chat with Pierce and with each other. Yet their attentiveness shows in their postures as they factor to beat the Tax Man. They clearly feel good when they win rounds. "You wasted him," says one boy to his friend in appreciation of one of these victories.

Pierce says he hates "pure arcade stuff" and does not buy software that has kids shooting down space ships, but he defends Tax Man on the grounds that it is an individually paced opportunity for kids to become comfortable with numbers, and comfort with numbers, he says, is "more important than the times table" as an objective in a math class like this one.

In one corner of the room, a boy works a keyboard that has been propped on the tray of his elaborate wheelchair. He has very limited dexterity, but he manages the task nonetheless. Next to him a young boy draws a pick-up truck in Logo. Nearby a middle school girl plays an entirely textual adventure game called Pythagoras and the Dragon. In another corner two students play a different adventure with a text in French. Almost all of the twenty machines in the room are busy now. Pierce tells us this is what he is used to. Sometimes he must hold "four or five simultaneous conversations with four or five different people ages five to eighteen." It is a pace he enjoys. He admits that it is "more tiring than splitting cord wood." Yet he adds quickly, "If you can run a room that's free, if you can stand that, you can do great stuff."

A quiet bell rings somewhere outside the room, and half the students respond by packing up their books to move onto their next class. The other half proceed with their keyboarding. The room must operate on three bell schedules simultaneously since the three schools' schedules are not synchronized. Nevertheless, the effect is not chaos but rather fluidity. The room does not entirely fill up or entirely empty out at regular intervals as most secondary and specialized elementary classrooms do. Here students come and go according to their own invisible schedules. And as they do, they appear quite purposeful. At one point, Pierce is several minutes late in returning from a math class he teaches in another room. When he catches up to his BASIC programming class however, every one of the students is already at work.

Throughout this October day, the computer room and almost all of its machines stay busy every minute from 7:30 AM until 4:30 P.M. First grade, fifth grade, sixth

grade, and special education classes all visit the room at various times. Generally the students in these classes work two by two on the machines as their teachers circulate among them. Also throughout the day, middle school and high school students — on passes from study halls — share the room with the visiting classes. At several points during the day, both of these groups overlap in their computer time with classes in computer programming. At times there are as many as four or five teachers in the room, and there are consistently at least twenty students. There are always computer aides in the room too. They are experienced computing students, who test the newly purchased software by using it, assist other students, label and sort disks, print out students' work, or just hang out. One of their main tasks is to maintain the room's schedule, but their presence, their knowledge of operations, and not incidentally, their visible interest, keep the program afloat. Pierce calls this the school-store style of management: "School stores tend to run themselves, don't they?"

All the kids we observe seem remarkably at ease with each other. We hear no put-downs and observe no tension or squabbling, despite crowding and an unusual age differential within the crowd. Pierce and middle school Logo teacher Larry Restuccia both attribute this harmony to the school's rural character— but to different aspects of it. Pierce says it is rooted in New Hampshire neighborliness. "When I drive to school each morning, I wave to every driver I pass and they wave to me. These kids have the same experience." But Restuccia, who used to teach in Boston, says that it is rooted in the fact that country kids, in contrast to city kids, get to work out a pecking order earlier. They know each other longer and better. A third possible root — another aspect of the rural experience here — may well be the school's ethnic, if not cultural, homogeneity. And a fourth possible

root — arguably rural in nature too — may simply be the open, neighborly personality of the man who runs the room.

Some Students

Jamie is a seventh grader. He comes into the computer room on a late afternoon, near the end of one of our visits. He looks hot and sweaty, his hair pasted to his forehead. He asks in excited, serious tones if he may use a word processing disk to finish his report on Texas. This report seems to consist wholly of lists drawn from an encyclopedia — lists of products, natural resources, and other facts about the state. His teacher told the class that they should do their reports on the word processor if they want to make them really neat. Although Jamie's printing — as revealed in his Texas notes — is bold and exceptionally neat, his cursive, he confides, is not neat at all. He loves word processing because "you can type it up yourself and erase your mistakes. It's much neater that way, much more easier for me." Computers are also fun, he reports, as he loads a disk drive. "If you get better at what you're doing now, you can do more." He says he once used the word processor to write a "book" about digestion; the book won a prize at the school's science fair.

Jamie used to have a small computer at home "but it got busted." It was in the middle of the floor one day and somebody kicked it. His mother, who is a shipper at Sylvania, cannot afford to buy a new one, so now Jamie spends his afternoons on one of the school's computers when he can find one unoccupied. He believes that his mother is happy with his interest in computers because he is getting good grades on his papers (though his test scores remain low). He attributes these good paper

grades to neatness. Asked if he thinks he may someday earn his living working on a computer, Jamie answers that maybe he will be a typist, though probably not a programmer because he isn't good at programming. In any case, he is not concerned yet about earning a living because he is only in the seventh grade.

Asked the same question, another visitor to the room, Michael, offers a more elaborate response. Michael plans to be ready for the day when computers "take over." What does he mean by "take over"? "Computers will run the major factories," he answers, "but they will need people to run the computers," and that is where he plans to come in. Computers will do dangerous jobs, he says, "like nuclear power plants and space exploration." And they will also drive cars. "You'll type in where you want to go, and the car will just go." But then, on the verge of another example, he hedges his bet. Even if computers don't take over, he says, at least they'll still make a good hobby, so he feels justified in continuing to study them.

Pierce describes Michael as one of his star computer aides. He also feels that the boy's interest in computers gets him through school. As his math teacher, Pierce credits computers with raising Michael's self-esteem enough to permit him "to rise from a gift D- to a C in algebra." Michael says that he plans to go to the voc-tech in Concord during his junior and senior years in order to continue his computer study. Pierce, however, who regards Michael as a programming whiz, thinks the voc-tech will not be able to give him the computer training he will need by the time he is a junior. He predicts that Michael will stay at Hillsboro-Deering High, and, having run out of the regular sequence of computer training normally offered there, will follow an independently arranged advanced sequence. "We'll have to make up courses for kids like this — you know, the ones we are bound to have soon who

are doing Pascal before they get to high school."

Most advanced programming students in the high school now are boys. An exception to this is Rachel, a senior who hopes for admission to Radcliffe next year, and who plans on a career as a math teacher. As she sits one day sorting and labeling disks, Rachel considers the question of why the boys of Hillsboro-Deering High have gotten more involved with its computers than the girls. She says she thinks that most girls never get turned on to computers because they do not find appeal in the "war games stuff" -- the adventure software and game-based math drills that seem to lure the boys to their first attachments. Furthermore, she thinks girls become bored faster than boys with the tedium of programming. The only thing that sustains her interest in computers, she says, is all the sophisticated math you can do on them.

The Scope and Sequence of Computer Instruction

The normal sequence of computer instruction which Rachel will soon complete and which Michael may outrun starts in kindergarten with four visits a year to the computer room to do some simple word processing and to play some of the games that Rachel describes as a particular lure for boys. In the first grade, classes visit more frequently and begin their study of Logo. Word processing, Logo programming, and experience with subject area software continue throughout the elementary grades, though Pierce says that the amount of computer time any child gets between the end of the first and the start of the eighth grades depends on which teachers the child has and how comfortable with computers those teachers are.

Although most of the elementary and middle school teachers (and all of the high school teachers) have taken Pierce's introductory programming course, he says that there are lingering disparities among them in both computer comfort and computer interest. That is one reason he likes to keep as many Apples as he can afford to do without circulating among elementary classrooms. "I've got a machine over in a teacher's second grade now with a handful of disks, but I didn't include word processing. So she's got this one kid who spends a lot of time in the computer room and he comes to me and says his teacher wants to know if we can have a word processing disk. Now, knowing that his teacher doesn't know anything about computers, I say to the kid, 'Know how to use it?' and he says 'Sure.' Now the kids in that classroom are going to learn from him." So, presumably, will his teacher.

Elementary principal Peggy McAllister takes a different view of her staff's readiness to work with computers. She claims that an initial reticence toward computing on the part of some teachers has disappeared entirely, attributing the difference to the staff's relative youth, and to her insistence that computer time be regarded as routine time rather than reward time, supportive of the rest of the curriculum, rather than competitive with it. To teach word processing is to teach the writing process, she declares; to teach Logo is to teach math and spatial concepts; to use educational software is to teach whatever the software teaches.

First grade teacher Trim Hahn is rather more circumspect in her support of microcomputer education for the children she teaches. She dislikes game-based software, echoing Rachel's claim that many girls find it unappealing. She also worries a little about the potential of what she calls too much experience with interactive media to retard the development of interpersonal skills among young

children. Nevertheless she appreciates the computer's pedagogical power. Much subject-area software may be "glorified paper", she says, but for some children, "the carryover" from computer work is greater than it is from paper work. And she feels very positive about Logo. Its commands tie in well with her phonics objectives, and she feels that working with Logo's "turtle graphics" gives her students important practice in applying concepts of distance, direction, and shape.

Finally, Hahn thinks word processing can be a valuable tool in introducing children to the writing process. She likes to send her first graders to the computer room in twos in order to put some of their writing onto disks. One partner dictates his or her composition to the other, who manipulates the keyboard, and then they switch roles. The benefits of such work, according to Hahn, lie in the opportunities it provides children to read their work to a responsive audience of one, to help each other experiment with sequencing, and to see their writing in print that is more concentrated and more adult-like in appearance than is the big-print they create by hand. A child -- or the child's teacher -- can see the composing work of three 25-minute computing sessions (perhaps three weeks' work) on a single page of print-out, rather than have to flip through many pages of large hand print, and so, claims Hahn, may see more clearly the composition's sequencing strengths and weaknesses.

In the middle school, all eighth graders must complete a formal course in Logo. They take the course twice a week for five weeks. It is taught by Larry Restuccia, who also teaches math, social studies, and reading. Restuccia likes programming for what he regards as its power to teach students logic and systematic procedural thinking. He also uses instructional software in his subject-area

teaching: math or state capitals drill; map making with a Koala Pad, historical simulations. He believes that many middle school students are hypersensitive and can take correction more easily from a machine which they know lacks feelings or hidden purposes than they can from a human teacher.

Do other middle school teachers integrate computer-based instruction into their teaching as he does? Restuccia admits that such integration is rare. Some teachers take an interest in software relevant to their department, and pass tips about it to their colleagues. Some encourage students to use word processing on reports. But most middle school teachers leave computing to the computer teachers. "This is still basically a computer room used to teach computers."

In the high school, most students take a nine-week course in BASIC some time before the senior year. If they do B work or better in this course, they can elect to continue work in BASIC for another quarter or two, during which they may rewrite some BASIC programs into Logo. Thereafter they can elect a three-month course in Pascal, and then independent studies.

Pierce teaches all the advanced sections and directs all the independent studies, but he shares the teaching of the introductory BASIC sections with fellow math teacher Buzz Levin. According to Pierce, he and Levin approach this teaching task in quite different ways, each way the product of a dissatisfaction they share with prevalent approaches and a determination they had to fashion a course fitting their individual notions of the basics of BASIC. Pierce clearly appreciates Levin's approach, encouraging him to share his long and detailed syllabus with us. However, he regards it as more conventional than his own, more dependent on traditional

teaching technique such as tests, and more dependent on students' math skills. Students may choose which BASIC course they take — the Pierce or the Levin model, and according to Pierce, those who prefer a greater degree of structure or a more academic experience choose the latter. "But the slower ones — the ones who haven't had any math — they won't pass his course," he says, "so they come to me." In one of his classes, he adds, only one student has had any Algebra I, but everyone is doing well with BASIC.

On the Farm: Time for Reflection

Ken Pierce is a farmer as well as a teacher. He and his wife breed thoroughbred horses and train them on a remote and hilly spread of pasturage in Deering. They have about as many horses as Ken has microcomputers back at school. Their doorbell on the farm is a spunky Jack Russell terrier who barks at whatever drives up the spiralled gravel road leading to barn and house. The house is actually two houses joined together, each representing an era in New Hampshire farm architecture. One is a white clapboard saltbox, the original farmhouse now used for storage, and the other is a modern, airy post and beam house that Pierce built himself with a friend who "knows beams."

He sits in his living room one early summer afternoon, postponing haying chores in order to talk more reflectively about school. The room is open to the roof, showing off its thick beams. Below them, the sitting furniture is plain, comfortable, slightly worn; several antique oil paintings hang on the walls; an antique hutch holds a silver chalice; and a large vase sits on an elegant pedestal very near an Apple II. The big front window offers a view, past fencing and grazing

horses, of a mountain which turns each winter into a ski resort but is now covered by green woods.

Although Pierce's speech often has a country quality, a New Hampshire backwoods plainspokenness, he is really a transplanted Connecticut suburbanite. Such roots give him a perspective, he claims, on the tendency of some people in the local community to set themselves apart as "classier" than others. "It's a joke," he says. "None of us is classy up here."

More than a characterization of the community, this statement also expresses the populist values that come out in his teaching. "Rednecks," a category into which Pierce puts himself, know how to spot pretentiousness, he suggests, and they find it less tolerable than city folks do. This is why he rails against what he perceives as the effort by the College board to push BASIC out of high schools in favor of Pascal, a language he regards as less accessible to low skilled students. "It's intellectual elitism," he complains, "the foolishness of ivory tower people." He regards efforts in general to reserve computer study for "the gifted" as "fraudulent, horrible, and not the American way." "It is the less skillful students," he argues, "who need computer literacy the most, who are most likely to suffer future shock without it."

Pierce thinks the fact that he is a farmer as well as a teacher sensitizes him to the concern for relevance that he thinks many rural children bring to their schooling. Having himself spent the dawn hours on farm chores, Pierce says he can understand how Billy, son of a milk farmer, might enter school each morning unsure of school's usefulness. But Pierce thinks there is something about the

microcomputer that helps overcome such doubts as Billy's. In math, he says, he "can't get the kid off his butt with a blowtorch," but Billy comes alive in the computer room. Is it more than just the computer's novelty that brings Billy to life? Is it a matter of his feeling in control sitting at his own keyboard? Is the experience of the rural student any different in this regard from that of the city or suburban child? Pierce has no ready answers for these questions. They are among many questions on his agenda of things to think about. At several points in our conversation, he hesitates to answer a particular question thoroughly, explaining that it is one he has been planning to think about or one that he is in the process of thinking about.

One large issue on this thinking agenda is the role of the microcomputer in the curriculum outside his own discipline of math. An English teacher he bumped into a year ago told him about her school's use of word processing to put out its newspaper. He thought about this small piece of information all last summer, he reports, and talked to many people about it. Now he believes that the microcomputer "could revolutionize English teaching." The assertion triggers a story. Last year he helped a student write a book report on the novel Lord of the Flies. One of the things he showed the boy was how easy it is to make changes in the middle of a report when you use word processing. "He thought that was a swell idea," Pierce relates, "because I know for him — and for me too when I was in school — you write that thing out and when you get to the last period, it's done. And if there's something in the middle that's not supposed to be there, that's tough!"

But writing is not the only place where Pierce envisions the computer transforming the traditional English curriculum. Another story: One day a student

asked him, "What's GOSUB mean?"

Pierce answered, "Look in the book."

"Where?"

"In the index."

"What?"

"Here."

"But how do I know which of these page numbers I'm supposed to turn to?"

"Check them out, one at a time."

Pierce lays out the point of his story: "That kid had been taught about indexes before, but this was the first time he was really ripe to learn it. Normally the English teacher talks about the index and everybody yawns and waits the twenty minutes for lunch to start."

What is it about the microcomputer that makes teaching to ripeness more practical? In answering this question Pierce touches a larger issue, one that is clearly the most critical on his thinking agenda. It concerns the possible effect of the microcomputer in shifting the locus of teaching interest from content to process, or of redefining knowledge as dynamic and interactive rather than static and bound.

Thus far, by defining his program so broadly and by buying so widely and eclectically in the software market, Pierce has evaded what he and McWalters thought would be a premature answer to the simple but central question: what are school computers for? As his program grows, however, as his room takes on more formality,

and as the political support for keeping this an open question grows less resolute, Pierce knows that he must prepare an answer.

To start with, he seems to have decided what he thinks school computers are NOT for. He reveals this once again in a story. He took a workshop recently on Apple repair, and another teacher in this workshop told him that microcomputer use in his school was tied to minimal competency testing. "So a kid in that school sits in front of the machine and keeps working on problems until he gets them right. So I asked the guy, 'How do the kids like that?' 'They hate it!' he said. Now I think there couldn't be a better way to take the glow off the computer. The kids don't even want to be near it because all it is is this spitting-out thing — saying YES or NO or whatever and keeping score. It's just like, just like a teacher! A teacher can do that!"

Then Pierce adds emphatically: "To use a computer to teach as a teacher teaches is a poor use of the resource." He is pleased to find an increasing supply of software that "goes beyond that."

Having thus dispatched much of computer-assisted instruction, Pierce is less definitive about what he regards as a good use of the resource. This is because certain kinds of computer learning, he explains, are hard to measure. "Unfortunately you can't get any federal money or anything by saying 'this is good for kids and they're having a good time, and yes, they ARE learning, but we're not exactly sure how to measure it."

How to measure what? What kind of learning does he mean? And how does it

differ from the kind of learning common in schools? Pierce replies, "In the normal school curriculum we don't teach how to think. Indirect reasoning is touched on maybe twice in the whole math curriculum. Computers are a good tool to teach reasoning, thinking habits, precision. . . . You know, we sometimes accept a paper or something turned in by a student that's very mediocre and half-baked, but you take it because it's the best thing they've ever done, but the computer just won't do that. It's got to be right or the computer will spit at you forever. It won't call you a jerk; it just won't work."

A Philosophical Difference

Most of the Hillsboro-Deering teachers and administrators with whom we spoke consider Pierce's microcomputers complementary to the rest of the curriculum -- whether they confine their sense of the machines' usefulness to the teaching of computer literacy or see in them some potential for a more integrated function. Only Pierce, however, seems to have any notion of the power of these machines to transform rather than complement the rest of the curriculum. To this extent, it might be said that only he still feels keenly what McWalters felt, if inchoately in his case, namely that a freewheeling microcomputer operation might transform teaching in the Hillsboro-Deering schools.

From the beginning of his tenure in the school system, Pierce has regarded his work as something of a mission, part of the larger mission for excellence that McWalters inspired. His computer department was not to be just one department among others, but rather what might be called an infra-department. His role was to be something like the role he played aboard ship during his naval career. Then, Pierce

explains, he was an auxiliary engineer rather than the much more common main propulsion engineer. The business of main propulsion engineers is to keep the ship going, but auxiliary engineers are concerned only with the "critical periphery" — the heat, light, water, and other systems that are crucial to the ship's whole operation but seldom noticed in their own right because they remain so integral.

"In main propulsion jobs," says Pierce, "you get into a situation where everybody is always looking over your shoulder, and everybody knows how to do your job, but an auxiliary officer's job is different. They leave you alone, which is nice."

It is clear that Ken Pierce is still regarded in Hillsboro-Deering as something like an auxiliary engineer — but one whose work is now more properly maintenance than development. His computer operation is still for nearly everyone a symbol of excellence, but now of excellence achieved rather than achievable. The system owns twenty microcomputers; even Pierce agrees that the computer room could not accommodate another (though he has plans for locating a few in other areas); almost the entire staff has had some computer training; there is an elaborate K-12 computer curriculum in place; what more CAN be achieved? The notion that the microcomputer might somehow be a tool for revamping curriculum, for shifting the locus of teaching and learning from a preoccupation with content to a preoccupation with experience, seems a foreign one to Superintendent Watman, among others.

Watman is deeply appreciative of Pierce's work, but is also quite eager to move his system out of an era of turbulence and into one of stability. With a laugh, he characterizes his own administrative style during the McWalters housecleaning era as

"arbitrary, capricious, and dictatorial," but says the style he prefers temperamentally is the more democratic one he can now afford since he has a staff with whom he can feel free to share power. For him, the end of the era of broad change in Hillsboro-Deering certainly does not mean the absolute end of growth in the computer program, however, because for him the two were linked only complementarily, not inextricably. "We're still getting yes answers" from the board, he says, on questions involving computers. In fact, he looks forward to becoming the first New Hampshire superintendent of schools to use his computer to marshal facts and figures at an annual district meeting. Yet he seems to agree with school board member Robert Charon, who thinks Hillsboro-Deering is nearing the end of its great computer growth spurt. "Local budgets can only sustain special efforts for a short time," says Watman. "Then other priorities have to take precedence."

Meanwhile, worried that he may have "bought into a system" that was closer to its peak than to its bottom, Ken Pierce has taken on the task of negotiating a new teacher contract with the board. It is, in effect, his end-run, a substitute mission while he thinks through what it means to be regarded as a winner but to fail to feel like one, to be the evidence of excellence rather than the instrument of it. So he has taken up the job of insisting to the board that excellence requires a salary increase, one big enough to attract and hold excellent teachers. If he had his way, he says, he would institute a system of merit pay, starting at $15,000, and going up to $35,000. "You make it clear to the world," he says, "that you are willing to pay the most, and you'll get the best." He advocates one-year contracts, "after which, if they don't like you, they fire you."

When Pierce believes in something, according to his own characterization, he

"can get fairly arrogant about it." So the negotiations have become rather heated. Board member Charon, himself a fiery and determined negotiator for the other side, insists that the impasse represents a "friendly disagreement," but his colleague Stephen Hahn says it is a source of "bitterness." The latter feels "very frustrated by the whole situation," saying he understands Pierce's determination and its roots in a vision of excellence, but also appreciates the feeling in the community that there are insufficient resources to fund this vision. As one taxpayer put it in her eagerness to slow school spending, "This is not Manchester, not Boston. You can just go so far in a small town." Echoing her sentiments, one teacher asks rhetorically and sadly, "How excellent a school can a New Hampshire mill town support?"

Conclusion

The Hillsboro-Deering school reform story offers an interesting twist on the now-familiar rural drama of oldtimers and newcomers. A common plot in this drama is for newcomers to move in, demand new and better municipal services of various sorts, and precipitate a rise in taxes. This sequence of events sets off a reaction from oldtimers who resent paying higher taxes and resent even more strongly the implication that the way things had been done for years and years isn't good enough for these city people, who are trying to make the rural setting more like the city they fled. It appears that in Hillsboro-Deering, the oldtimers themselves were impatient with the state of their schools, so that when ex-Wall Street lawyer McWalters began to clean house, they gave him their approval to keep on cleaning. The oldtimers used this new broom to sweep clean. The fact that McWalters had not grown up in the community and was neither enmeshed in the web of relationships that

constrains change in a rural community nor temperamentally reserved in the New England manner seems to have made him an ideal candidate for Chief Housecleaner.

Watman and his point man Ken Pierce clearly regarded the microcomputer as a tool that might give them the leverage needed to lift the school district's whole program of instruction toward "excellence." With a computer room open to teachers as well as students, Pierce became a kind of internal change agent for the system. But he may have fallen victim to a classic pattern in educational change efforts: the agent of change is encapsulated as his program becomes an annex to the system rather than a transformer of it. Pierce continues to reach out to other teachers, but at this point his efforts are less an expression of the school district's "excellence" movement and more a simple expression of his own evangelical enthusiasm.

In a small system like Hillsboro-Deering's, a committed individual can make a difference. That is the good news. But an individual restless enough to bring about change can also be worn down or simply leave the system. Psychologically, McWalters has already made his exit. The question then becomes, how long will an energetic cosmopolitan like Pierce remain in Hillsboro-Deering?

Within the computer room itself, Pierce's loose experimentation is just beginning to give way to formalization. The change in the physical environment reflects the shift. Some formalization seems both inevitable and perhaps even desirable. But the questions here are whether the formalization will retain those elements of Pierce's program that most excite and motivate students and whether students' motivation can be channeled into learning in the core subject areas in the

curriculum. It is at this point that reflection on the experience to date, articulation of what has been learned about education with computers, and a renewal of reform efforts become essential if the full potential of the computer is to be realized.

In summing up what McWalters, Pierce, and others have accomplished with microcomputers in Hillsboro-Deering, it is important to include the extraordinary influence of the program on individual students. The computer room is a strikingly welcome interstice in the formal system of instruction -- a crack into which students don't fall, but through which they can see some educational activities that are intrinsically compelling and that give them a sense of achievement, of mastery over the dominant technology of our time. This in itself is no small achievement, especially in a rural environment where it would be all too easy for students to see computers as one more instrument of a remote and alien urban society.